RESILIENT INFRASTRUCTURE
June 1–4, 2016

USING LIF TO ESTABLISH MONITORING WELL NETWORK OF MIGRATING LNAPL PLUME IN THE VICINITY OF SURFACE WATER

Laura J Jones
Golder Associates Ltd., Canada

ABSTRACT

The former Michigan Avenue Landfill (the "Site", now Canatara Park) was used by the City of Sarnia for disposal of municipal waste between approximately 1930 and 1967. Between approximately 1930 and 1944, oily waste was reportedly disposed of at the Site from one of the local refineries. This waste material was reportedly a by-product of a process that used clay to remove colour impurities during the production of automobile lubricating oil.

In 1997, light non-aqueous phase liquid (LNAPL) was discovered at the southwest shore of Lake Chipican, north of the Site. In response, temporary measures were taken by the City to contain and collect the oil film at the lake. In 2000, remedial measures were developed to mitigate the discharges from the Site including installation of a 70-metre-long sheet-pile barrier wall along the south shore of Lake Chipican and installation of two oil recovery wells south of the barrier wall.

An annual monitoring program commenced in 2000, to detect LNAPL at monitoring locations prior to potential migration to Lake Chipican. During routine monitoring in October 2011, LNAPL was detected in a sentry well located near the west end of the barrier wall which prompted additional remedial measures.

Since LNAPL was discovered in a sentry well, a subsurface investigation was undertaken to determine the current extent of LNAPL in the vicinity of Lake Chipican. The subsurface investigation used Laser Induced Fluorescence (LIF) to delineate the extent of the LNAPL plume and to determine locations for additional monitoring wells to provide advance warning of plume migration prior to encountering sensitive receptors. LIF uses a built-in laser to emit short pulses of light of a certain wavelength range. Polycyclic aromatic hydrocarbons (PAHs), present in the automobile lubricating oil, fluoresce when excited by light of a known wavelength and emit light of a specific wavelength range. LIF provides rapid semi-quantitative results in the field to allow for quick decision making regarding progress of the investigation.

In April 2012 and April 2013, an LIF investigation was completed at 49 locations and monitoring wells were installed at 9 locations near Lake Chipican and associated surface water bodies to provide advanced warning of LNAPL plume migration. Figure 1 illustrates the current extent of LNAPL in the Lake Chipican Area and LIF Investigation points. The LIF program was able to identify a narrow band of migrating LNAPL. Monitoring wells were installed in locations beyond the migrating LNAPL plume to provide advance warning of further migration of LNAPL towards surface water bodies. The LIF program was able to achieve high resolution data in the field, which allowed the investigation to proceed in a systematic way and allow for cost effective delineation of the LNAPL in one mobilization using a finer spacing between locations than would be used using monitoring wells.

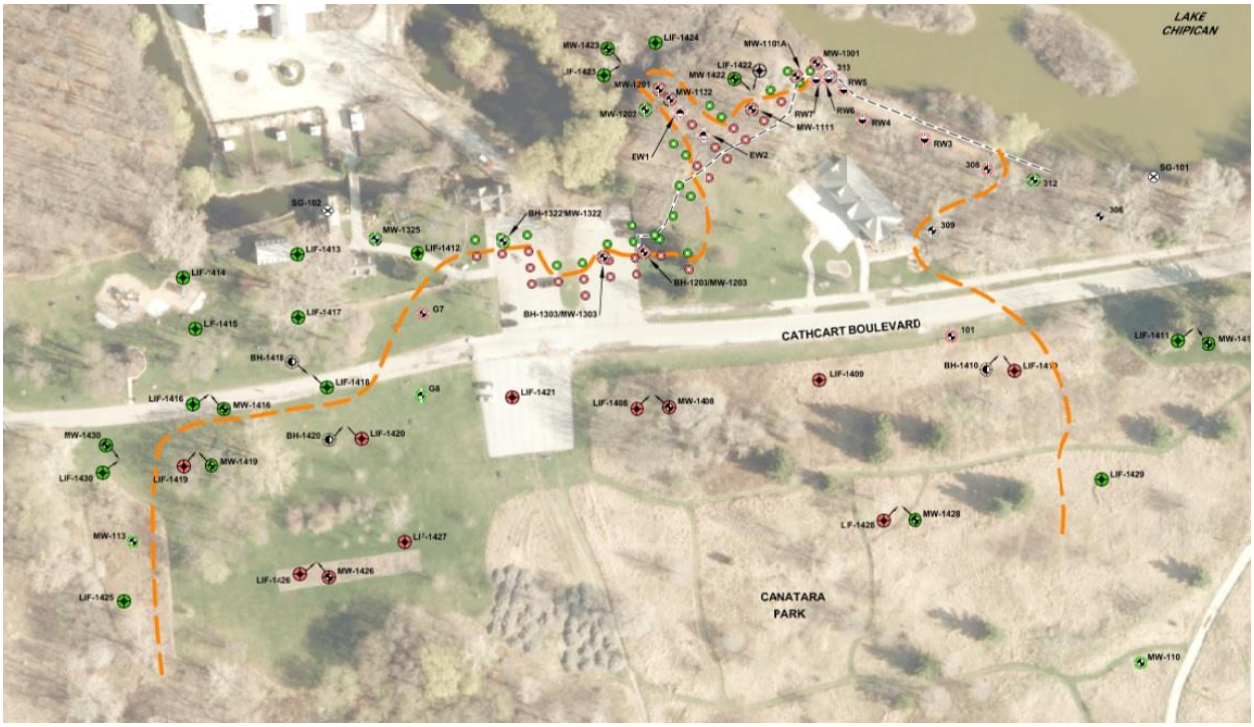

Figure 1: Final Extent of LNAPL from LIF Investigations

The additional wells were incorporated into the annual groundwater monitoring program and have been included as trigger wells in the Trigger and Contingency Plan for the Site. Since start of the LIF investigation program, additional LNAPL migration has been discovered based on the network of monitoring wells installed and results of the LIF investigations.

The results of the investigation and the benefits of using LIF over traditional investigation techniques will be presented in a case study format.

Keywords: LNAPL, LIF, High Resolution Site Characterization